The effect of bilateral eye-movements versus no eye-movements on sexual fantasies

Bartels, Ross M.; Harkins, Leigh; Harrison, Samantha C.; Beard, Nikki; Beech, Anthony R.

DOI:
10.1016/j.jbtep.2018.01.001

Document Version
Peer reviewed version

Citation for published version (Harvard):
Bartels, RM, Harkins, L, Harrison, SC, Beard, N & Beech, AR 2018, 'The effect of bilateral eye-movements versus no eye-movements on sexual fantasies', *Journal of Behavior Therapy and Experimental Psychiatry*, vol. 59, pp. 107-114. https://doi.org/10.1016/j.jbtep.2018.01.001

Accepted Manuscript

The effect of bilateral eye-movements versus no eye-movements on sexual fantasies

Ross M. Bartels, Leigh Harkins, Samantha C. Harrison, Nikki Beard, Anthony R. Beech

PII: S0005-7916(17)30179-9

DOI: 10.1016/j.jbtep.2018.01.001

Reference: BTEP 1363

To appear in: *Journal of Behavior Therapy and Experimental Psychiatry*

Received Date: 14 August 2017

Revised Date: 22 December 2017

Accepted Date: 2 January 2018

Please cite this article as: Bartels, R.M., Harkins, L., Harrison, S.C., Beard, N., Beech, A.R., The effect of bilateral eye-movements versus no eye-movements on sexual fantasies, *Journal of Behavior Therapy and Experimental Psychiatry* (2018), doi: 10.1016/j.jbtep.2018.01.001.

Sexual fantasies become less vivid, positive, and arousing after making bilateral eye-movements

Ross M. Bartels[a*], Leigh Harkins[b],

Samantha C. Harrison[a], Nikki Beard[a], & Anthony R. Beech[c]

[a]School of Psychology, University of Lincoln, Lincoln, LN6 7TS, UK. Email:

rbartels@lincoln.ac.uk, 13381114@students.lincoln.ac.uk, 11358098@students.lincoln.ac.uk

[b]Faculty of Social Science and Humanities, University of Ontario Institute of Technology

Oshawa, ON, Canada. Email: leigh.harkins@uoit.ca

[c]School of Psychology, University of Birmingham Edgbaston, Birmingham, B15 2TT, UK
Email: a.r.beech@bham.ac.uk

*Details for corresponding author: Dr. Ross Bartels, School of Psychology, University of Lincoln, Lincoln, LN6 7TS, UK; Email: rbartels@lincoln.ac.uk

The effect of bilateral eye-movements versus no eye-movements on sexual fantasies

Abstract

Background and Objectives*:* Bilateral eye-movements (EMs) and visual mental imagery both require working memory resources. When performed together, they compete for these resources, which can cause various forms of mental imagery to become impaired (e.g., less vivid). This study aimed to examine whether EMs impair sexual fantasies (a form of mental imagery) in the same manner.

Methods: Eighty undergraduates (40 males, 40 females) took part in four counterbalanced conditions: (1) EMs and an experience-based sexual fantasy; (2) EMs and an imagination-based sexual fantasy; (3) experience-based sexual fantasy only; and (4) imagination-based sexual fantasy only. In each condition, the vividness, emotionality, and arousability of the sexual fantasy were rated pre- and post-task. All three variables were predicted to decrease in the EM conditions.

Results*:* Sexual fantasies were reported as less vivid, positive, and arousing after performing concurrent EMs relative to fantasising only, for both memory- and imagination-based sexual fantasies. There were no gender differences. Demand did not appear to account for the effects.

Limitations: Self-report measures were used rather than objective measures. Working memory taxation and capacity were not directly assessed. Also, negatively appraised sexual fantasies were not targeted and a 'no intervention' control was not included.

Conclusions: Bilateral EMs were effective at impairing the phenomenological properties of sexual mental imagery, extending the literature on EM effects. Given the potential clinical implications, future research should focus on validating and extending these results, for example, by targeting negatively appraised sexual fantasies (including problematic and offense-related) and incorporating a 'no intervention' condition.

Keywords: Sexual fantasy; Eye-movements; Mental imagery; Working memory; EMDR

The effect of bilateral eye-movements versus no eye-movements on sexual fantasies

1. Introduction

Sexual fantasy is defined as "almost any mental imagery that is sexually arousing or erotic to the individual" (Leitenberg & Henning, 1995; p.470) and is thought to be the most common form of human sexual experience (Ellis & Symon, 1990). Leitenberg and Henning (1995) report that approximately 95% of men and women from the general population report having used a sexual fantasy in one context or another, with the most common reason being to induce or enhance a state of sexual arousal. While the content of sexual fantasies are diverse, factor analyses suggest that they typically fall within four overarching themes (Arndt, Foehl, & Good, 1985; Crépault & Couture, 1980; Wilson & Lang, 1981). These include: 1) conventional sexual activity with either a real or imaginary lover; 2) scenarios of sexual power or irresistibility; 3) varied settings, practices, and positions; and 4) dominance and/or submission scenarios. The most popular fantasies for both genders include reliving an exciting sexual experience, imagining having sex with a current partner, and imagining having sex with another partner (Leitenberg & Henning, 1995). Thus, the imagery within sexual fantasies can include both recalled memories and imagined scenarios (Rokach, 1990).

The use of sexual fantasies is generally considered to be a positive experience, often indicative of an active and satisfying sex life (Hunt, 1974; Kaplan, 1974; Leitenberg & Henning, 1995). However, sexual fantasies can be experienced as negative. For example, some women regard their own sexual fantasies involving submission as negative (Byers, Purdon, & Clark, 1998; Moyano & Sierra, 2014), while some men who sexually fantasise about themes of dominance report them as negative (Byers et al., 1998). Renaud and Byers (2006) found that men and women who have experienced sexual coercion in adulthood report more negative sexual fantasies involving submission. Also, clinicians and researchers have

noted that some female survivors of childhood sexual abuse report negatively appraised sexual fantasies involving force, humiliation, or pain, as well as inappropriate partners (Briere, 1992; Maltz, 2000; Westerlund, 1992; Wilson & Wilson, 2008). In response to these observations, Maltz (1992) developed a therapeutic model of 'sexual healing' that involves a component related to addressing negative sexual fantasies. Finally, sexual fantasies depicting non-consensual, harmful, or underage sexual themes can be problematic given their link to sexual offending (Bartels & Gannon, 2011). This link can include enhancing and maintaining deviant sexual interests (Laws & Marshall, 1990) and/or being linked to sexually deviant behaviour (Klein, Schmidt, Turner, & Briken, 2015; Turner-Moore & Waterman, 2016).

Given that certain sexual fantasies can pose a problem for some individuals, it is important that clinicians have theoretically-sound and empirically-supported strategies available to treat them. A number of behavioural strategies have been developed to help reduce sexual arousal to problematic sexual fantasies (Laws & Marshall, 1991). These include pairing the problematic sexual fantasy with an aversive stimulus (e.g., olfactory aversion, ammonia aversion, covert sensitization) or pairing masturbation with a more appropriate (e.g., non-deviant) sexual fantasy (e.g., masturbatory satiation, directed masturbation). While these methods are typically used to treat deviant sexual fantasies used by sex offenders (McGrath, Cumming, Burchard, Zeoli, & Ellerby, 2009; Vanhoeck, Van Daele, & Gykiere, 2011), they have also been used in other clinical contexts. For example, Wilson and Wilson (2008) report successfully using an aversion-based strategy with a female survivor of childhood sexual abuse who reported sexual fantasies involving sexual abuse cues. Although some behavioural methods are used in sex offender treatment programmes (particularly covert sensitisation; see McGrath et al., 2009), the evidence base for the efficacy of behavioural strategies in reducing sexual arousal towards deviant sexual fantasies both limited and not strong (Beech & Harkins, 2012). Moreover, they involve many practical

issues that have led to their decline in use (or lack of increased use). As Maletzky (1996) notes, "aversive conditioning is messy, expensive, cumbersome, and unattractive. Worse, it is hard work…" (p. 263).

In light of the above, there is a need for an alternative approach to treating problematic sexual fantasies. Since sexual fantasies are a form of mental imagery, cognitive-based imagery techniques may be one option for therapeutically addressing problematic sexual fantasies. 'Imagery techniques' (Holmes, Arntz, & Smucker, 2007) have become of increasing interest within other domains of clinical psychology, such as PTSD, social phobia, depression, and craving (Hackmann, Bennett-Levy, & Holmes, 2011). According to Holmes et al. (2007), imagery techniques are divided into those that are direct (or 'imagery-interactive') and those that are indirect (i.e., concerned with 'imagery-properties'). The former deals directly with the content of the imagery, while the latter deals with how problematic imagery is perceived and includes what Holmes et al. (2007) call 'imagery-competing tasks'. These are techniques that disrupt the cognitive processes underlying mental imagery so that the imagery becomes impaired. (e.g., less vivid and/or emotional). It is these 'imagery-competing tasks' that are of focus in the present study.

Research suggests that imagery-competing tasks require working memory resources (Gunter & Bodner, 2008; Kemps, Tiggemann, Woods, & Soekov, 2004; van den Hout, Engelhard, Beetsma et al., 2011). Working memory (WM) is conceptualised as a limited-capacity system that temporarily stores information needed to complete a cognitive operation (Baddeley & Hitch, 1974). It is comprised of a central executive that controls the operation of two subsidiary 'slave' systems; the visuospatial sketchpad and the phonological loop. The former subsystem is necessary for the retention and manipulation of visual information, while the latter does the same for auditory information. Notably, the maintenance of visual information in the visuospatial sketchpad is thought to be necessary for mental imagery

(Baddeley & Andrade, 2000; Kosslyn, 1994). Thus, if a task known to tax WM is performed at the same time as envisioning mental imagery, there will be competition for the limited resources of WM. As a result, the mental imagery is likely to become impaired in some manner (e.g., reduced vividness).

Research has identified a number of imagery-competing tasks that impair mental imagery. These include attentional breathing (van den Hout, Engelhard, Beetsma et al., 2011); mental arithmetic (Engelhard, van den Hout, & Smeets, 2011); the computer game *Tetris* (Engelhard, van Uijen, & van den Hout, 2010); and clay modelling (Andrade, Pears, May, & Kavanagh, 2012). However, the most widely researched task is bilateral eye-movements (EMs), which have been shown to tax working memory resources (Engelhard et al., 2010a; van den Hout, Engelhard, Beetsma et al., 2011; van den Hout, Engelhard, Rijkeboer et al., 2011). Numerous studies have demonstrated that bilateral EMs reduce the vividness and/or emotional intensity of various types of mental imagery. These include negative memories (Andrade, Kavanagh, & Baddeley, 1997; Engelhard et al., 2010a; Gunter & Bodner, 2008; Maxfield, Melnyk, & Hayman, 2008; van den Hout, Muris, Salemink, & Kindt, 2001; van den Hout, Engelhard, Beetsma et al., 2011; van den Hout, Engelhard, Rijkeboer et al., 2011); positive memories (Engelhard et al., 2010a; Hornsveld et al., 2011; van den Hout et al., 2001); negative imagined threat about the future (Engelhard, van den Hout, Janssen, & van der Beek, 2010; Engelhard, van den Hout, Dek et al., 2011); and substance-related imagery (Kemps et al., 2004; Littel, van den Hout, & Engelhard, 2016). It is worth also noting that bilateral EMs are typically used during Eye-Movement Desensitisation and Reprocessing therapy (EDMR; Shapiro, 1989) as a way of treating traumatic mental imagery, and have been found to be an effective component of EMDR therapy (Lee & Cuijpers, 2013; van den Hout & Engelhard, 2012).

Sexual fantasising involves envisioning mental imagery (either recalled or imagined) that involves a sexual scenario, and is theorised to require the resources of working memory (Bartels & Beech, 2016). This suggests that EMs will impair sexual fantasies in the same manner as other forms of mental imagery. As a first step to testing this hypothesis, the present study investigated whether EMs impair the sexual fantasies used by a non-clinical sample of university students. Given that this study was approached as a 'proof-of-concept' (in terms of whether the EM paradigm can be applied to sexual fantasies), we focused on frequently used sexual fantasies, as opposed to negatively appraised or clinically/forensically-relevant sexual fantasies. Drawing upon the methods used in previous EM research, this study comprised two Experimental conditions (i.e., envisioning sexual fantasies based on a past experience [experience-based] while making EMs; and envisioning sexual fantasies unrelated to past experience [imagination-based] while making EMs), and two Control conditions (i.e., envisioning experience-based sexual fantasy with no EMs; and envisioning imagination-based sexual fantasy with no EMs). Within each condition, sexual fantasies were rated on three variables (emotionality, vividness, and arousability[1]) before and after the task. It was hypothesised that EMs would decrease the vividness, emotionality, and arousability of sexual fantasies relative to sexual fantasising alone, irrespective of whether they were experience- or imagination-based.

2. Method

2.1 Participants

A sample of 80 student participants (40 females and 40 males) was recruited to take part in this study. The sample had a mean age of 19.4 years old (*SD*=1.1) and was comprised

[1] Arousability was added in this study as it was deemed relevant to sexual imagery. This is similar Kemps et al. (2004) who measured craving in relation to food imagery (i.e., an effect relevant to that particular form of mental imagery).

of White (86%), Asian (8%), Black (1%), Mixed race (4%), and Hispanic (1%) participants. The majority of participants were heterosexual (86%), with 5% identifying homosexual, 7.5% as bisexual, and 1 participant not providing data.

2.2 Measures and materials

Wilson Sexual Fantasy Questionnaire (WSFQ; Wilson, 1978). The WSFQ uses a 6-point Likert-type scale to measure how frequently respondents use 40 different sexual fantasies. In this study, the WSFQ was used as a means to determine the most frequently used sexual fantasies for use in the experimental task. As such, participants were also asked whether each sexual fantasy (that they reported using) originated from a previous experience or purely from their imagination (i.e., not based on a previous experience).

Visual analogue scales. Following previous EM studies (e.g., van den Hout, Engelhard, Beetsma et al., 2011), emotionality, vividness, and arousability levels for each sexual fantasy were measured using visual analogue scales (VAS). Each VAS was comprised of a single 10cm line with descriptive anchors at each end. Thus, each VAS ranged from zero to 10. The emotionality VAS ran from ‘extremely unpleasant’ (left) to ‘extremely pleasant’ (right); the vividness VAS ran from ‘not clear at all’ (left) to ‘very clear’ (extreme right); and the arousability VAS ran from ‘extremely non-arousing’ (left) to ‘extremely arousing’ (right).

Eye-movement task. Using an experimental software package (E-Prime), a 1cm wide white dot was programmed to move back and forth across a computer screen (black background) at a speed of 1.0 Hz (i.e., one left-right-left cycle per second). The horizontal movement of the white dot is designed to facilitate bilateral eye-movements in participants and has been effectively used by previous researchers (van den Hout, Engelhard, Beetsma et al., 2011). As in previous studies, the dot was programmed to make 24 full right-to-left movements over four separate blocks (24 per block). Each block was separated by a 10

second break. Thus, the task involved 96 EM movements in total, following the design of previous EM studies (e.g., van den Hout et al., 2001; Engelhard et al., 2010b).

A similar task was also programmed for the control (no EMs) condition. This simply involved a blank black screen being displayed for four 24-second blocks. During the presentation of the blank screen, participants were required to just envision a sexual fantasy. As in the experimental condition, each block was separated by 10 second rest period.

2.3 Procedure

Ethical approval for this study was granted by two UK-based universities in which this study was conducted. Each participant entered the lab to take part in a study examining the cognitive processes underlying sexual fantasising. After taking a seat in front of the computer, all participants first completed the WSFQ. The researcher then chose four sexual fantasies from the completed WSFQ; two based upon a memory and two based upon imagination. That is, the researcher noted all of the most frequently used fantasies (i.e., those with a score of 3 or more), picked four (all with the same score where possible), and then randomly allocated them each to a condition for use in the main experiment.

Following completion of the WSFQ, all participants were first told to envisage a sexual fantasy for 20 seconds. Participants were informed on which of the four selected fantasies they had to envision. After the 20 seconds, participants rated the fantasy's emotionality, vividness, and arousability using the VAS. Next, all participants took part in the four conditions (i.e., EM-Memory, EM-Imagination, No EM-Memory, and No EM-Imagination), the order of which was counterbalanced between participants. Also, within each condition, the order of fantasy type (i.e., memory versus imagination) was counterbalanced between participants.

During the experimental conditions, participants had to visualise a sexual fantasy while simultaneously making 96 EMs (by following the white dot on-screen). After the EM task, participants had to visualise the same sexual fantasy for another 20 seconds and re-rate its emotionality, vividness, and arousability. This procedure was completed twice: one for an experience-based fantasy and one for an imagination-based fantasy. In the two control conditions, participants simply visualised their experience- and imagination-based fantasies with their eyes open for a period of 96 seconds, again in a counterbalanced order. No eye-movements were made. After each control task, participants re-visualised and re-rated the sexual fantasy. After the study ended, each participant was thanked and fully debriefed.

3. Results

Table 1 shows the mean pre-task ratings and post-task ratings for vividness, emotionality, and arousability of both experience- and imagination-based sexual fantasies across male and female participants, as well as the full sample. As shown, there is a trend for the ratings to decrease in the EM condition and increase in the No-EM (control) condition. To examine whether EMs (versus no-EMs) affected sexual fantasies, as well as whether any change was affected by fantasy type and gender, separate 2 (Time; pre- task vs. post- task) x 2 (Condition: EM vs control) x 2 (Fantasy type; experience-based vs. imagination-based) x 2 (Gender; male vs. female) mixed ANOVAs were conducted on vividness, emotionality, and arousability ratings. Time, Condition, and Fantasy Type were within-subjects factors, while Gender was the between-subjects factor. In the following section, we report all significant results and relevant follow-up analyses. However, all main and interaction effects are reported in Table 2.

Table 1. Means (SD) of vividness, emotionality, and arousability of sexual fantasies before and after eye-movements

		Experience-based				Imagination-based			
		Eye-movements		**Fantasy only**		**Eye-movements**		**Fantasy only**	
Sample	Variable	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Male	Vividness	7.54 (1.99)	5.83 (2.63)	7.73 (1.99)	7.54 (2.18)	6.19 (2.28)	4.81 (2.58)	6.17 (1.84)	6.49 (2.23)
	Emotionality	7.79 (1.58)	6.89 (1.85)	7.99 (1.43)	7.68 (1.71)	7.04 (2.30)	6.16 (2.17)	7.09 (1.93)	6.78 (2.03)
	Arousability	7.30 (1.87)	6.48 (2.33)	7.23 (1.96)	7.35 (2.18)	6.88 (2.53)	5.71 (2.55)	6.89 (2.11)	6.62 (2.33)
Female	Vividness	7.85 (1.52)	6.92 (2.27)	7.98 (1.45)	8.56 (1.56)	5.91 (2.52)	5.87 (2.43)	5.56 (2.38)	6.92 (2.18)
	Emotionality	7.50 (1.70)	7.26 (1.77)	7.72 (1.76)	8.03 (1.97)	6.79 (2.21)	6.41 (2.17)	6.37 (2.25)	6.71 (2.58)
	Arousability	7.39 (1.64)	6.74 (2.00)	7.36 (2.04)	7.78 (2.09)	6.32 (2.45)	5.73 (2.57)	6.13 (2.46)	6.51 (2.49)
Total	Vividness	7.69 (1.77)	6.38 (2.49)	7.85 (1.73)	8.05 (1.95)	6.05 (2.39)	5.34 (2.55)	5.86 (2.14)	6.70 (2.19)
	Emotionality	7.64 (1.64)	7.08 (1.81)	7.72 (1.76)	7.86 (1.84)	6.92 (2.25)	6.28 (2.16)	6.73 (2.12)	6.74 (2.31)
	Arousability	7.34 (1.75)	6.61 (2.16)	7.29 (1.99)	7.56 (2.13)	6.60 (2.49)	5.72 (2.54)	6.51 (2.32)	6.56 (2.40)

Table 2. ANOVA results for vividness, emotionality, and arousability as a function of Time, Condition, Type, and Gender

		Vividness			Emotionality			Arousability		
	df	*F*	ηp^2	*p*	*F*	ηp^2	*p*	*F*	ηp^2	*p*
Time	1, 78	2.4	.03	.12	**6.11**	**.07**	**.02**	**5.84**	**.07**	**.02**
Condition	1, 78	**23.21**	**.23**	**<.001**	**5.83**	**.07**	**.02**	**6.72**	**.08**	**.01**
Type	1, 78	**85.73**	**.52**	**<.001**	20.81	.07	.07	**17.12**	**.18**	**<.001**
Gender	1, 78	1.56	.02	.22	.07	.001	.79	.03	.00	.85
Time x Condition	1, 78	**37.38**	**.32**	**<.001**	**14.95**	**.16**	**<.001**	**24.33**	**.24**	**<.001**
Time x Type	1, 78	**13.19**	**.15**	**.001**	.05	.001	.78	1.32	.02	.25
Time x Gender	1, 78	**9.55**	**.11**	**.003**	**6.37**	**.08**	**.01**	2.51	.03	.12
Condition x Type	1, 78	1.39	.02	.24	**1.79**	**.19**	**.02**	.08	.001	.78
Condition x Gender	1, 78	.74	.009	.39	.59	.007	.45	.01	.00	.93
Gender x Type	1, 78	2.52	.03	.12	.31	.004	.58	1.98	.03	.16
Condition x Type x Time	1, 78	.01	.00	.92	.09	.001	.77	.06	.001	.81
Condition x Gender x Time	1, 78	.11	.001	.74	.05	.001	.83	.07	.001	.79
Condition x Gender x Type	1, 78	.57	.007	.46	.55	.007	.46	.28	.004	.60
Time x Type x Gender	1, 78	1.44	.02	.23	.08	.001	.78	1.41	.02	.24
Time x Type x Gender x Condition	1, 78	.19	.003	.66	.12	.001	.75	.01	.00	.91

Note. Statistically significant effects are in bold.

3.1 Vividness

First, paired *t*-tests showed that pre-task (baseline) vividness ratings did not significantly differ between the EM and No-EM conditions for the experience-based fantasies, $t(79) = 0.66$, $p = .51$, or the imagination-based fantasies, $t(79) = 0.68$, $p = .47$. As shown in Table 2, the results of the four-way ANOVA revealed a significant main effect of Condition, $F(1,78) = 23.21$, $p < .001$, and Fantasy Type, $F(1,78) = 85.73$, $p < .001$. There was also a significant Time x Gender interaction, $F(1,78) = 9.55$, $p = .003$. Simple main effects (with Bonferroni corrections) showed that males produced generally higher pre-task vividness ratings ($M = 6.91$, $SE = .22$) than post-task ratings ($M = 6.17$, $SE = .29$), whereas females did not show any differences. A Time x Type interaction was also observed, $F(1, 78) = 13.19$, $p < .001$. Simple main effects revealed that experience-based fantasies were rated as more vivid than imagination-based fantasies at both the pre-task ($M = 7.77$, $SE = .16$ vs. 5.96, $SE = .21$) and post-task stage ($M = 7.21$, $SE = .21$ vs. 6.02, $SE = .23$). The crucial Time x Condition interaction was found to be significant, $F(1,78) = 37.38$, $p < .001$.

In order to meaningfully decompose the Time x Condition interaction, a planned paired *t*-test was conducted on the mean difference scores (i.e., pre-test minus post-test ratings) for each condition (for the full sample and across both fantasy types). As can be seen in Figure 1, vividness decreased in the EM condition but increased in the control condition (no EMs). The paired *t*-test revealed that the change in vividness after EMs was significantly different that observed in the control condition, $t(79) = 6.15$, $p < .001$, $d = -0.77$. Next, we compared pre- and post-task ratings for each condition. In the EM condition, pre-task vividness ($M = 6.87$, $SD = 1.66$) was rated significantly greater than post-task vividness ($M = 5.86$, $SD = 2.32$), $t(79) = 3.99$, $p < .001$, $d = 0.46$. In the no-EM condition, pre-task vividness ($M = 6.86$, SD = 1.59) was significantly lower than post-task vividness ($M = 7.37$, $SD = 1.84$), $t(79) = -3.44$, $p = .001$, $d = -0.38$. Finally, we compared the post-task ratings between conditions. Post-task

vividness was rated as significantly lower in the EM condition than the No-EM condition, $t(79) = -6.96$, $p < .001$, $d = -0.80$.

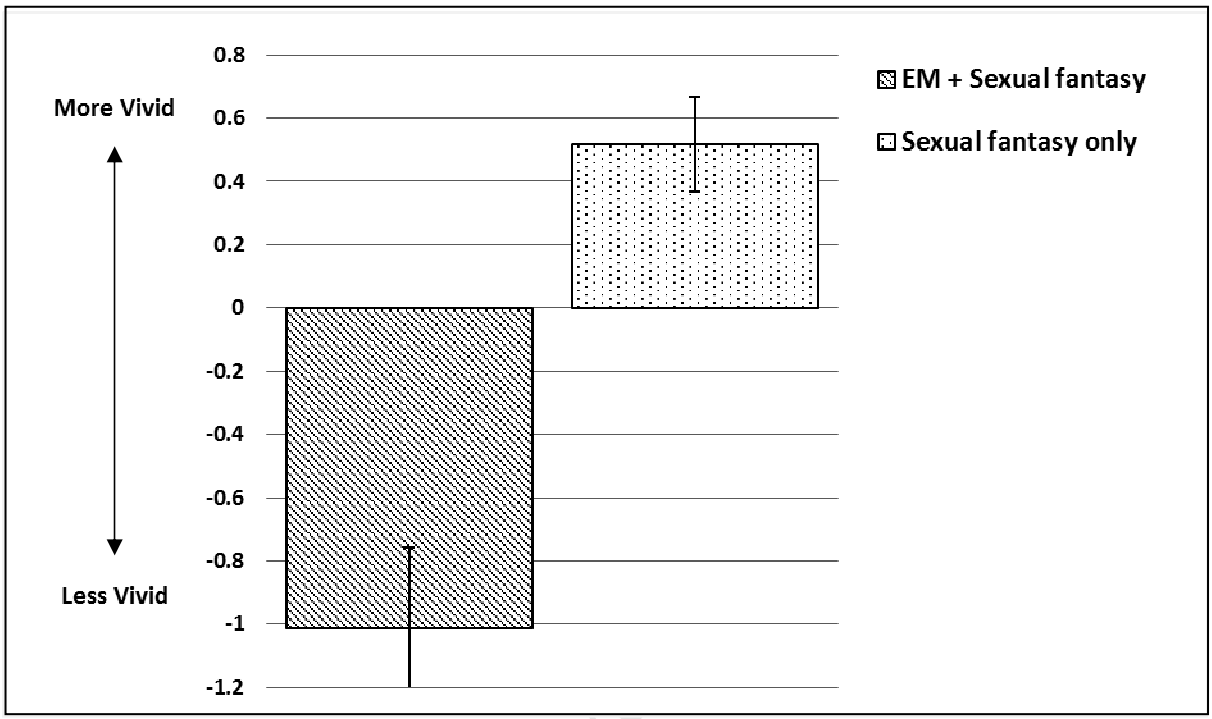

Figure 1: Mean difference scores for vividness per condition. Error bars represent standard error of the mean.

3.2 Emotionality

As with vividness, paired *t*-tests showed that the baseline ratings for emotionality did not differ between conditions for either experience-based fantasies, $t(79) = 1.14$, $p = .26$, or imagination-based fantasies, $t(79) = 0.82$, $p = .41$. The four-way ANOVA conducted on the emotionality ratings revealed a significant main effect of Time, $F(1, 78) = 6.11$, $p = .02$, Condition, $F(1, 78) = 5.83$, $p = .02$, and Fantasy Type, $F(1, 78) = 20.81$, $p < .001$. Again, the Time x Gender interaction was significant, $F(1, 78) = 6.37$, $p = .01$. Similar to the vividness data, simple main effects (with Bonferroni corrections) indicated that males rated emotionality higher at the pre-task stage ($M = 7.43$, $SE = .21$) than the post-task stage ($M = 6.88$, $SE = .25$), while females did not show any differences. There was also a significant

Condition x Type interaction, $F(1, 78) = 1.79$, $p = .02$. Bonferroni corrected simple main effects indicated that, within the EM condition (collapsed across time points), experience-based sexual fantasies ($M = 7.36$, $SE = .17$) were rated as more pleasant than imagination-based fantasies ($M = 6.60$, $SE = .23$, $p = .003$). There were no differences between experience- and imagination-based fantasies in the control condition ($M = 7.86$, $SE = .17$ vs. $M = 6.73$, $SE = .24$, $p = .53$).

Crucially, the Time x Condition interaction was also significant, $F(1, 78) = 14.95$, $p < .001$. The mean difference scores for the EM and control condition (for the full sample and across fantasy type) were again analysed using a planned paired *t*-test. As shown in Figure 2, the change in emotionality after EMs was significantly different to the change in emotionality found in the control condition, $t(79) = 3.89$, $p < .001$, $d = -0.44$. In the EM condition, pre-task emotionality ($M = 7.28$, $SD = 1.55$) was rated significantly greater than post-task emotionality ($M = 6.68$, $SD = 1.73$), $t(79) = 3.85$, $p < .001$, $d = 0.43$. However, in the No-EM condition, pre-task emotionality ($M = 7.29$, SD = 1.46) did not significantly differ from post-task emotionality ($M = 7.30$, $SD = 1.66$), $t(79) = -0.06$, $p = .95$, $d = -0.01$. Finally, post-task emotionality was rated as significantly lower in the EM condition than the No-EM condition, $t(79) = -3.98$, $p < .001$, $d = -0.45$.

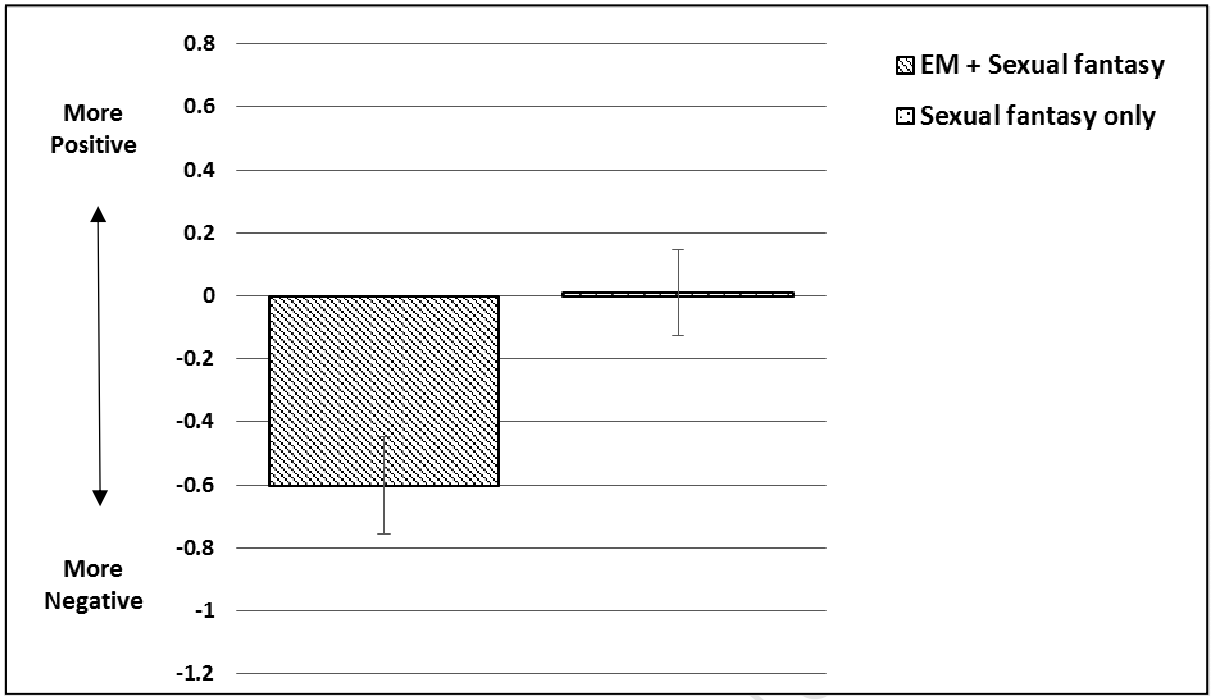

Figure 2: Mean difference scores for emotionality per condition. Error bars represent standard error of the mean.

3.3 Arousability

Paired *t*-tests showed that the baseline arousability ratings did not differ between conditions for experience-based fantasies, $t(79) = 0.21$, $p = .83$, or imagination-based fantasies, $t(79) = 0.39$, $p = .69$. The four-way ANOVA conducted on the arousability ratings revealed a significant main effect of Time, $F(1, 78) = 5.84$, $p = .02$, Condition, $F(1, 78) = 6.72$, $p = .01$, and Fantasy Type, $F(1, 78) = 17.12$, $p < .001$. The only significant interaction was the crucial Time x Condition interaction, $F(1, 78) = 24.33$, $p < .001$). As Figure 3 shows, the decrease in arousability following EMs was significantly different to the change in arousability found in the control condition, $t(79) = 4.96$, $p < .001$, $d = -0.57$. Further, pre-task arousability ($M = 6.97$, $SD = 1.79$) was rated significantly greater than post-task arousability ($M = 6.16$, $SD = 2.10$) in the EM condition, $t(79) = 4.25$, $p < .001$, $d = 0.48$. In the No-EM condition, pre-task arousability ($M = 6.90$, SD = 1.68) did differ from post-task arousability ($M = 7.06$, $SD = 1.96$), $t(79) = -1.14$, $p = .26$, $d = -0.13$. When comparing post-task ratings

between conditions, arousability was found to be significantly lower in the EM condition than the No-EM condition, $t(79) = -3.98$, $p < .001$, $d = -0.47$.

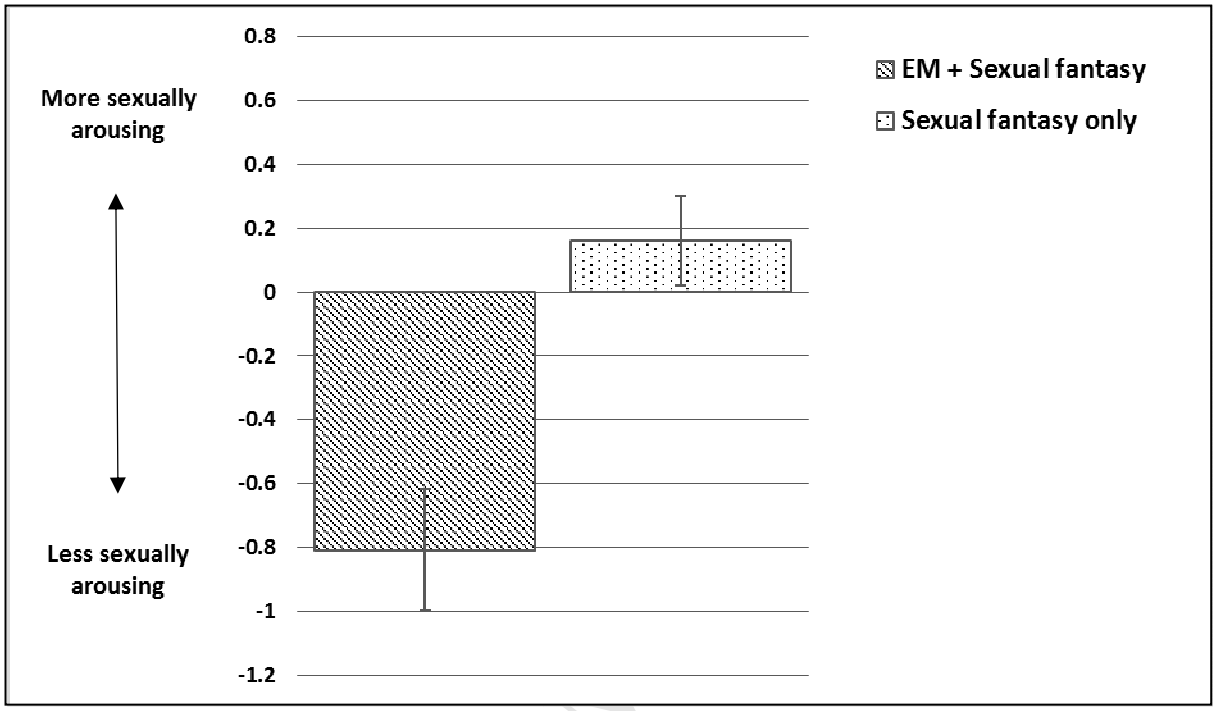

Figure 3: Mean difference scores for arousability per condition. Error bars represent standard error of the mean.

3.4 Post-hoc examination of possible demand effects

The above results suggest that EMs caused a decrease in each dependent variable, which supports our hypothesis. However, it is possible the results were affected by demand characteristics. That is, given that all participants engaged in both conditions, they may have formed an idea of what the study aimed to test half-way through and, thus, responded in a manner that confirms the hypotheses. Given that the conditions were counterbalanced, the plausibility of demand having played a role could be inspected using the data from the present study. In other words, a larger decrease from pre- to post-task ratings would be expected for participants who completed the EM condition after the No-EM condition, versus those who performed the EM task first. To test this, the ANOVA tests were re-run with 'Task

Order' entered as a between-subjects factor. If demand played a role, it would emerge as an interaction between Time and Task Order. The three-way interaction between Time, Condition, and Task Order was not significant for vividness ($F(1, 75) = 2.05$, $p = .16$, $\eta^2 = .03$), emotionality ($F(1, 75) = 0.16$, $p = .90$, $\eta^2 = .00$), and arousability ($F(1, 75) = 1.53$, $p = .22$, $\eta^2 = .02$). Also, the two-way interaction between Time and Task Order was non-significant for vividness ($F(1, 75) = 0.14$, $p = .71$, $\eta^2 = .002$), , emotionality, ($F(1, 75) = 0.02$, $p = .89$, $\eta^2 = .00$), and arousability ($F(1, 75) = 0.12$, $p = .73$, $\eta^2 = .002$). These results argue against the idea that the findings were due to demand.

4. Discussion

Previous research demonstrates that EMs and visual mental imagery compete for the resources of WM when performed concurrently, which causes the imagery to become impaired (i.e., less vivid). On the basis that sexual fantasising is a controlled process that involves envisioning visual mental imagery (Bartels & Beech, 2016), it was hypothesised that sexual fantasies will also compete with EMs for WM resources. This would be evident by a reduction in vividness, emotionality, and arousability of the participants' sexual fantasies. The findings supported these hypotheses. That is, self-reported vividness, emotionality, and arousability were decreased in the EM condition, relative to the control condition (i.e., fantasising with no EMs) across all participants. This effect occurred regardless of whether the sexual fantasies were experience-based or imagination-based, and did differ between males and females. Furthermore, ancillary analyses indicated that demand (potentially caused by the within-subjects design) did not account for the findings. Also, data from the control condition showed that vividness ratings significantly increased after the sexual imagery was simply envisioned (i.e., with no EMs).

To the authors' knowledge, this is the first study to investigate and demonstrate that bilateral EMs can impair the phenomenological properties of sexual fantasies. Moreover, these results are a novel addition to the existing research on EMs, as they demonstrate that the effect of EMs extends to sexual mental imagery. Also, that both experience- and imagination-based fantasies were impaired supports previous studies showing that EMs impair both memories (van den Hout et al., 2001) and imagined future events (Engelhard et al., 2010b). Further, since sexual fantasies are typically experienced as a positive and enjoyable activity (Ellis & Symons., 1990), the results support previous findings that EMs impair positive mental imagery (Hornsveld et al., 2011).

The present EM effects may be explained by the work of other researchers within this domain. Gunter and Bodner (2008) postulated that EMs 'use up' WM resources causing a reduction in the quality of the mental imagery (i.e., lowered vividness). This lowered vividness causes the imagery to be appraised as less emotional. Put differently, after performing EMs, individuals find themselves appraising lower quality mental imagery. In support of this, Smeets, Dijs, Pervan, Engelhard, and van den Hout (2012) found that vividness decreased before emotionality following EMs (2 seconds vs. 74 seconds, respectively). Drawing upon Kosslyn's (1994) 'visual imagery theory', Smeets et al. (2012) proposed that visual information held in the visuospatial sketchpad of WM needs to be refreshed in order to maintain the vividness of the mental imagery. EMs interfere with this refreshment process leading to lowered imagery vividness. The affected imagery may then be reconsolidated into memory as less vivid when the EM task ends. Thus, when recalled after the task, the same imagery is experienced as less vivid and, in turn, appraised as having less emotional valence. In the present study, it can be argued that EMs interfered with the refreshment of sexual visual information held in WM, which reduced the vividness of the sexual fantasies and, in turn, led to lowered ratings of emotionality and arousability.

It should be noted, however, that some prior studies have found a decrease in vividness but not emotionality (e.g., van den Hout, Engelhard, Beetsma et al., 2011, Study 2). While this may be due to methodological or statistical power issues, it does challenge the account proposed by Smeets et al. (2012). Moreover, in a recent review, Agren (2014) noted that an integral aspect of memory reconsolidation is that it is a time-dependent process. Thus, the effects of reconsolidation disruption will only be seen after the reconsolidation process has concluded (e.g., after 24 hours; Hupbach, Gomez, Hardt, & Nadel, 2007; Nader, Schafe, & LeDoux, 2000). Since, in the present study, sexual imagery was recalled immediately after the EM manipulation, the observed reductions in memory vividness cannot be explained by memory reconsolidation disruption. Another explanation is that reductions in vividness from pre- to post-test may reflect a temporary and/or context-dependent change in the accessibility of the memory attributes caused by EMs (Leer, Engelhard, Lenaert, Struyf, Vervliet & Hermans, 2017). Corroborating this view could involve testing whether vividness reverts back to baseline after a substantial delay (i.e., due to accessibility returning). Another explanation is that participants may be confusing memory attributes experienced during post-task recall with those experienced during the EM intervention (Van den Hout et al., 2001). Future research could consider having participants rate the memory's attributes using hand-held response dials *during* post-task recall.

Another observation in this study is that vividness ratings increased in the No-EM condition. It is not clear why this increase was found. It may be an effect of mere exposure (indicating the need for a 'no intervention' control condition in future work). However, it would be expected that the effects of mere exposure would also apply to emotionality and arousability, which was not the case here. While the repeated formation of mental imagery has been found to increase imagery vividness (Campos, Gómez-Juncal, & Pérez-Fabello, 2008), we argue that further research is needed to help explain how this occurs.

Given that this is the first investigation into the effects of EMs on sexual fantasies, it is important to address the study's limitations. First, the dependant variables were measured subjectively using self-report, which are prone to dissimulation. Future research should examine whether objectively measured sexual arousal and vividness are reduced by EMs. Second, it is difficult to ascertain whether the participants were actually envisioning the sexual fantasies during the tasks. It is possible that participants did not envision certain (or any) sexual fantasies during the conditions or had trouble keeping them in mind due to natural 'mindwandering'. This is always an issue with mental imagery research and needs further examination. For example, the use of an objective measure of sexual arousal could also be helpful here, as changes in sexual arousal (relative to non-sexual imagery) would support the view that sexual fantasies were being envisioned by participants.

Third, the sexual fantasies that the participants had to envision were chosen by the researcher. Thus, it would be beneficial for follow-up studies to use a more rigorous method of selecting and allocating fantasies to each condition, or have participants choose the fantasies to use. Fourth, no measures were made to confirm that WM was being taxed by EMs. Future research could look to include a condition involving a less demanding task (i.e., that requires fewer WM resources) and compare the findings to EMs. However, as discussed earlier, previous researchers have found support for the assumption that WM is taxed by EMs (Engelhard et al., 2010a; van den Hout, Engelhard, Beetsma et al., 2011). For example, the effects of EMs on memory impairment are stronger for those with lower WM capacity (Gunter & Bodner, 2008). Thus, there is sufficient evidence for assuming that WM was taxed by the EM procedure in this study. Fifth, we did not include a delayed post-test period. Thus, it cannot be known whether changes in vividness, emotionality, and arousability remain at follow-up. Previous studies using negative memories have found that EM effects can last for up to a week later (Gunter & Bodner, 2008), as well as 24-hours later using a larger number

of EMs (Leer, Engelhard, & Van den Hout, 2014). Future research should investigate whether EM effects remain after a delayed post-test, as well as whether it is influenced by treatment duration (Leer et al., 2014). Such findings would have important implications for clinical practice. Finally, no systematic efforts were made to assess pre-existing knowledge of EMDR in order to account for the possible biasing effect this may have had on the results. This should be accounted for in future research.

In spite of these limitations, the results of this study provide promising avenues for future research. They also offer some important, albeit preliminary, theoretical and practical implications. On a theoretical level, the findings contribute to our understanding of the processes that underpin the act of sexual fantasising. That is, they indirectly support Bartels and Beech's (2016) proposition that sexual fantasising is a controlled cognitive process requiring the resources of WM. It is important, however, that further research is conducted to corroborate these findings. At a practical level, the present findings provide the first indication that 'imagery-competing tasks' - specifically eye-movements - may be a useful treatment strategy for problematic sexual fantasies. Indeed, Vanhoeck et al. (2011) argue that EMDR therapy (which typically involves using bilateral EMs) may be useful for reducing deviant sexual fantasies related to an offender's sexual victimisation in childhood (Ricci, Clayton, & Shapiro, 2006).

However, it is important to emphasise that, at this point in time, the present study only provides a proof of concept in relation to the effect of EMs on sexual fantasies. Thus, before applying the EM paradigm to problematic sexual fantasies in clinical research or clinical practice, more lab-based research is needed to corroborate the effects and extend the research. For instance, negatively appraised (or problematic) sexual fantasies need to be directly targeted in follow-up studies. Further, the effects observed in this study were modest, with moderate effects sizes found between pre- and post-testing. It is recommended that efforts are

made to increase the effects. For example, Leer et al. (2014) found that treatment duration (i.e., the use of more EMs) resulted in more enduring effects on negative memories (i.e., 24hrs later). Also, van Veen et al. (2015) found faster EMs (at a speed of 1.2Hz) led to stronger effects with regards to negative memories. This provides two further avenues for future research. Also, 'mere exposure' effects may have led to the increased post-task vividness ratings in the No-EM condition. Thus, a 'no intervention' control condition should be incorporated into the design of future studies.

4.1 Conclusion

This study found that EMs help decrease the vividness, emotional intensity, and arousability of both experience-based and imagination-based sexual fantasies. These findings suggest that envisioning sexual mental imagery (i.e., sexual fantasising) draws upon WM resources and that EMs could have potential as a treatment strategy for problematic sexual fantasies. It is now important to corroborate and extend these results in further lab-based studies, before being applied to clinical/forensic populations.

References

Agren, T. (2014). Human reconsolidation: a reactivation and update. *Brain Research Bulletin, 105*, 70-82. doi:10.1016/j.brainresbull.2013.12.010.

Andrade, J., Kavanagh, D., & Baddeley, A. (1997). Eye-movements and visual imagery: A working memory approach to the treatment of post-traumatic stress disorder. *British Journal of Clinical Psychology, 36,* 209-223. doi: 10.1111/j.2044-8260.1997.tb01408.x.

Andrade, J., Pears, S., May, J., & Kavanagh, D. J. (2012). Use of a clay modeling task to reduce chocolate craving. *Appetite, 58,* 955-963. doi: 10.1016/j.appet.2012.02.044.

Arndt, W. B., Foehl, J. C, & Good, F. E. (1985). Specific sexual fantasy themes: A multidimensional study. *Journal of Personality and Social Psychology, 48,* 472-480. doi: 10.1037/0022-3514.48.2.472.

Baddeley, A.D., & Andrade, J. (2000). Working memory and the vividness of imagery. *Journal of Experimental Psychology: General, 129,* 126–145. doi: 10.1037/0096-3445.129.1.126.

Baddeley, A.D., & Hitch, G.J. (1974). Working memory. In G.A. Bower (Ed.), *Recent advances in learning and motivation* (Vol. 8, pp. 47–90). New York: Academic Press. doi: 10.1016/S0079-7421(08)60452-1.

Bartels, R. M., & Beech, A. R. (2016). Theories of deviant sexual fantasy. In *The Wiley Handbook on the Theories, Assessment, & Treatment of Sexual Offending*, (Ed). D. P. Boer. *Volume I: Theories*, (Ed) A. R. Beech, & T. Ward. John Wiley & Sons. doi:10.1002/9781118574003.wattso008.

Bartels, R. M., & Gannon, T. A. (2011). Understanding the sexual fantasies of sex offenders and their correlates. *Aggression and Violent Behavior, 16,* 551-561. doi: 10.1016/j.avb.2011.08.002.

Briere, J. (1992). *Child abuse trauma: Theory and treatment of the lasting effects.* Newbury Park, CA: Sage Publishing.

Byers, E. S., Purdon, C., & Clark, D. A. (1998). Sexual intrusive thoughts of college students. *Journal of Sex Research, 35*, 359-369. doi: 10.1080/00224499809551954. doi: 10.2190/LKJY-H294-5ATB-JQVL.

Campos, A., Gómez-Juncal, R., & Pérez-Fabello, M. J. (2008). Experience in imagery and imagery vividness. *Imagination, Cognition and Personality, 27,* 337-348. doi:10.2190/IC.27.4.d.

Crépault C., & Couture, M. (1980). Men's erotic fantasies. *Archives of Sexual Behavior, 9*, 565-581. doi: 10.1007/BF01542159.

Ellis, B. J., & Symons, D. (1990). Sex differences in sexual fantasy: An evolutionary psychological approach. *Journal of Sex Research, 27*, 527-555. doi: 10.1080/00224499009551579.

Engelhard, I. M., van Uijen, S. L., & van den Hout, M. A. (2010). The impact of taxing working memory on negative and positive memories. *European Journal of Psychotraumatology, 1*, 5623. doi: 10.3402/ejpt.v1i0.5623.

Engelhard, I. M., van den Hout, M. A., Janssen, W. C., & van der Beek, J. (2010b). Eye movements reduce vividness and emotionality of "flashforwards". *Behaviour Research and Therapy*, *48*, 442-447. doi: 10.1016/j.brat.2010.01.003.

Engelhard, I. M., van den Hout, M. A., & Smeets, M. A. (2011). Taxing working memory reduces vividness and emotional intensity of images about the Queen's Day tragedy. *Journal of Behavior Therapy and Experimental Psychiatry, 42*, 32-37. doi: 10.1016/j.jbtep.2010.09.004.

Engelhard, I. M., van den Hout, M. A., Dek, E. C., Giele, C. L., van der Wielen, J. W., Reijnen, M. J., & van Roij, B. (2011). Reducing vividness and emotional intensity of

recurrent “flashforwards” by taxing working memory: An analogue study. *Journal of Anxiety Disorders, 25*, 599-603. doi: 10.1016/j.janxdis.2011.01.009.

Gunter, R. W., & Bodner, G. E. (2008). How eye movements affect unpleasant memories: Support for a working-memory account. *Behaviour Research and Therapy, 46*, 913–931. doi: 10.1016/j.brat.2008.04.006.

Hackmann, A., Bennett-Levy, J., & Holmes, E. A. (Eds.). (2011). *Oxford guide to imagery in cognitive therapy*. Oxford: Oxford University Press.

Holmes, E. A., Arntz, A., & Smucker, M. R. (2007). Imagery rescripting in cognitive behaviour therapy: Images, treatment techniques and outcomes. *Journal of Behavior Therapy and Experimental Psychiatry, 38*, 297-305. doi: 10.1016/j.jbtep.2007.10.007.

Hornsveld, H. K., Houtveen, J. H., Vroomen, M., Aalbers, I. K. D., Aalbers, D., & van den Hout, M. A. (2011). Evaluating the effect of eye movements on positive memories such as those used in resource development and installation. *Journal of EMDR Practice and Research, 5*, 146-155. doi: 10.1891/1933-3196.5.4.146.

Hunt, M. (1974). *Sexual behavior in the 70's.* Chicago: Playboy Press.

Hupbach, A., Gomez, R., Hardt, O., & Nadel, L. (2007). Reconsolidation of episodic memories: A subtle reminder triggers integration of new information. *Learning & Memory, 14*, 47–53. doi:10.1101/lm. 365707

Kaplan, H. S. (1974). Fiction and fantasy: No-nonsense therapy for six sexual malfunctions. *Psychology Today*, 77-86.

Kemps, E., Tiggemann, M., Woods, D., & Soekov, B. (2004). Reduction of food cravings through concurrent visuospatial processing. *International Journal of Eating Disorders, 36*, 31-40. doi: 10.1002/eat.20005.

Klein, V., Schmidt, A. F., Turner, D., & Briken, P. (2015). Are sex drive and hypersexuality

associated with pedophilic interest and child sexual abuse in a male community sample? *PLoS ONE, 10,* e0139533. doi:10.1371/journal.pone.0129730.

Kosslyn S. M. (1994). *Image and brain: The resolution of the imagery debate.* Cambridge, MA: MIT Press.

Laws, D. R., & Marshall, W. L. (1990). A conditioning theory of the etiology and maintenance of deviant sexual preferences and behavior. In W. L. Marshall, D. R. Laws, & H. E. Barbaree (Eds.), *Handbook of sexual assault: Issues, theories, and treatment of the offender* (pp. 209–230). New York: Plenum Press.

Laws, D. R., & Marshall, W. L. (1991). Masturbatory reconditioning with sexual deviates: An evaluative review. *Advances in Behaviour Research and Therapy, 13,* 13-25. doi: 10.1016/0146-6402(91)90012-Y.

Lee, C. W., & Cuijpers, P. (2013). A meta-analysis of the contribution of eye movements in processing emotional memories. *Journal of Behavior Therapy and Experimental Psychiatry, 44,* 231-239. doi: 10.1016/j.jbtep.2012.11.001.

Leer, A., Engelhard, I. M., & Van Den Hout, M. A. (2014). How eye movements in EMDR work: Changes in memory vividness and emotionality. *Journal of Behavior Therapy and Experimental Psychiatry, 45,* 396-401. doi:10.1016/j.jbtep.2014.04.004.

Leer, A., Engelhard, I. M., Lenaert, B., Struyf, D., Vervliet, B., & Hermans, D. (2017). Eye movement during recall reduces objective memory performance: An extended replication. *Behaviour Research and Therapy, 92,* 94-105. doi:10.1016/j.brat.2017.03.002

Leitenberg, H., & Henning, K. (1995). Sexual fantasy. *Psychological Bulletin, 117,* 469–496. doi:10.1037/0033-2909.117.3.469.

Littel, M., van den Hout, M. A., & Engelhard, I. M. (2016). Desensitizing addiction: Using

eye movements to reduce the intensity of substance-related mental imagery and craving. *Frontiers in Psychiatry, 7,* 14. doi:10.3389/fpsyt.2016.00014.

Maltz, W. (1992). *Sexual healing journey: A guide for survivors of sexual abuse*. New York: Harper Perennial.

Maltz, W. (2000). Sexual healing from sexual abuse. *Siecus Report, 29,* 17-23.

Maxfield, L., Melnyk, W. T., & Hayman, G. C. (2008). A working memory explanation for the effects of eye movements in EMDR. *Journal of EMDR Practice and Research, 2,* 247-261. doi: 10.1891/1933-3196.2.4.247.

Moyano, N., & Sierra, J. C. (2014). Positive and negative sexual cognitions: similarities and differences between men and women from southern Spain. *Sexual and Relationship Therapy,* 1-13. doi: 10.1080/14681994.2014.934667.

Nader, K., Schafe, G. E., & LeDoux, J. E. (2000). Reply — Reconsolidation: The labile nature of consolidation theory. *Nature Reviews Neuroscience, 1,* 216-219. doi:10.1038/35044580

Renaud, C. A., & Byers, S. E. (2006). Positive and negative cognitions of sexual submission: relationship to sexual violence. *Archives of Sexual Behavior, 35,* 483-490. doi: 10.1007/s10508-006-9046-2.

Ricci, R. J., Clayton, C. A., & Shapiro, F. (2006). Some effects of EMDR on previously abused child molesters: Theoretical reviews and preliminary findings. *The Journal of Forensic Psychiatry & Psychology, 17,* 538-562. doi: 10.1080/14789940601070431.

Rokach, A. (1990). Content analysis of sexual fantasies of males and females. *The Journal of Psychology, 124,* 427–436. doi: 10.1080/00223980.1990.10543238.

Shapiro, F. (1989). Efficacy of the eye movement desensitization procedure in the treatment of traumatic memories. *Journal of Traumatic Stress, 2,* 199-223. doi: 10.1016/0005-7916(89)90025-6.

Smeets, M. A., Dijs, M. W., Pervan, I., Engelhard, I. M., & Van den Hout, M. A. (2012). Time-course of eye movement-related decrease in vividness and emotionality of unpleasant autobiographical memories. *Memory, 20*, 346-357. doi: 10.1080/09658211.2012.665462.

Turner-Moore, T., & Waterman, M. (2017). Men presenting with sexual thoughts of children or coercion: flights of fancy or plans for crime? *The Journal of Sexual Medicine, 14*, 113-124. doi:10.1016/j.jsxm.2016.11.003.

van den Hout, M. A., Muris, P., Salemink, E., & Kindt, M. (2001). Autobiographical memories become less vivid and emotional after eye movements. *British Journal of Clinical Psychology, 40*, 121-130. doi: 10.1348/014466501163571.

van den Hout, M. A., & Engelhard, I. M. (2012). How does EMDR work? *Journal of Experimental Psychopathology, 3*, 724-738. doi: 10.5127/jep.028212.

van den Hout, M. A., Engelhard, I. M., Beetsma, D., Slofstra, C., Hornsveld, H., Houtveen, J., & Leer, A. (2011). EMDR and mindfulness. Eye movements and attentional breathing tax working memory and reduce vividness and emotionality of aversive ideation. *Journal of Behavior Therapy and Experimental Psychiatry*, *42*, 423-431. doi: 10.1016/j.jbtep.2011.03.004.

van den Hout, M. A., Engelhard, I. M., Rijkeboer, M. M., Koekebakker, J., Hornsveld, H., Leer, A., Toffolo, M. B. J., & Akse, N. (2011). EMDR: Eye movements superior to beeps in taxing working memory and reducing vividness of recollections. *Behaviour Research and Therapy, 49*, 92-98. doi: 10.1016/j.brat.2010.11.003.

Van Veen, S.C., Van Schie, K., Wijngaards-de Meij, L.D., Littel, M., Engelhard, I.M., & Van den Hout, M.A. (2015). Speed matters: Relationship between speed of eye movements and modification of aversive autobiographical memories. *Frontiers in Psychiatry, 6*, 45. doi: http://dx.doi.org/10.3389/fpsyt.2015. 00045.

Vanhoeck, K., Van Daele, E., & Gykiere, K. (2011). Fantasy Management in sex offender treatment. *Sexual Offender Treatment, 6*, http://www.sexual-offender-treatment.org/94.html.

Westerlund, E. (1992). *Women's sexuality after childhood incest.* New York: W.W. Norton & Company, Inc.

Wilson, G. (1978). *The secrets of sexual fantasy*. London: J.M. Dent & Sons.

Wilson, G. D., & Lang, R. J. (1981). Sex differences in sexual fantasy patterns. *Personality and Individual Differences, 2*, 343-346. doi: 10.1016/0191-8869(81)90093-3.

Wilson, J. E., & Wilson, K. M. (2008). Amelioration of sexual fantasies to sexual abuse cues in an adult survivor of childhood sexual abuse: A case study. *Journal of Behavior Therapy and Experimental Psychiatry, 39*, 417-423. doi: 10.1016/j.jbtep.2008.01.002.

Highlights

- Eye-movement effects on experience- and imagination-based sexual fantasies were tested.
- Sexual fantasy vividness, emotionality, and arousability were dependent variables.
- Eye-movements reduced all three variables relative to fantasising only.
- Effects of eye-movements on negative sexual fantasies need to be tested.